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NATIONAL FOREST WATERSHED PROJECTS IN ARIZONA

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SOUTHWESTERN REGION

Aerial view of "clear-cut block" in spruce-fir timber type, Burro Mountain Watershed, Apache National Forest.

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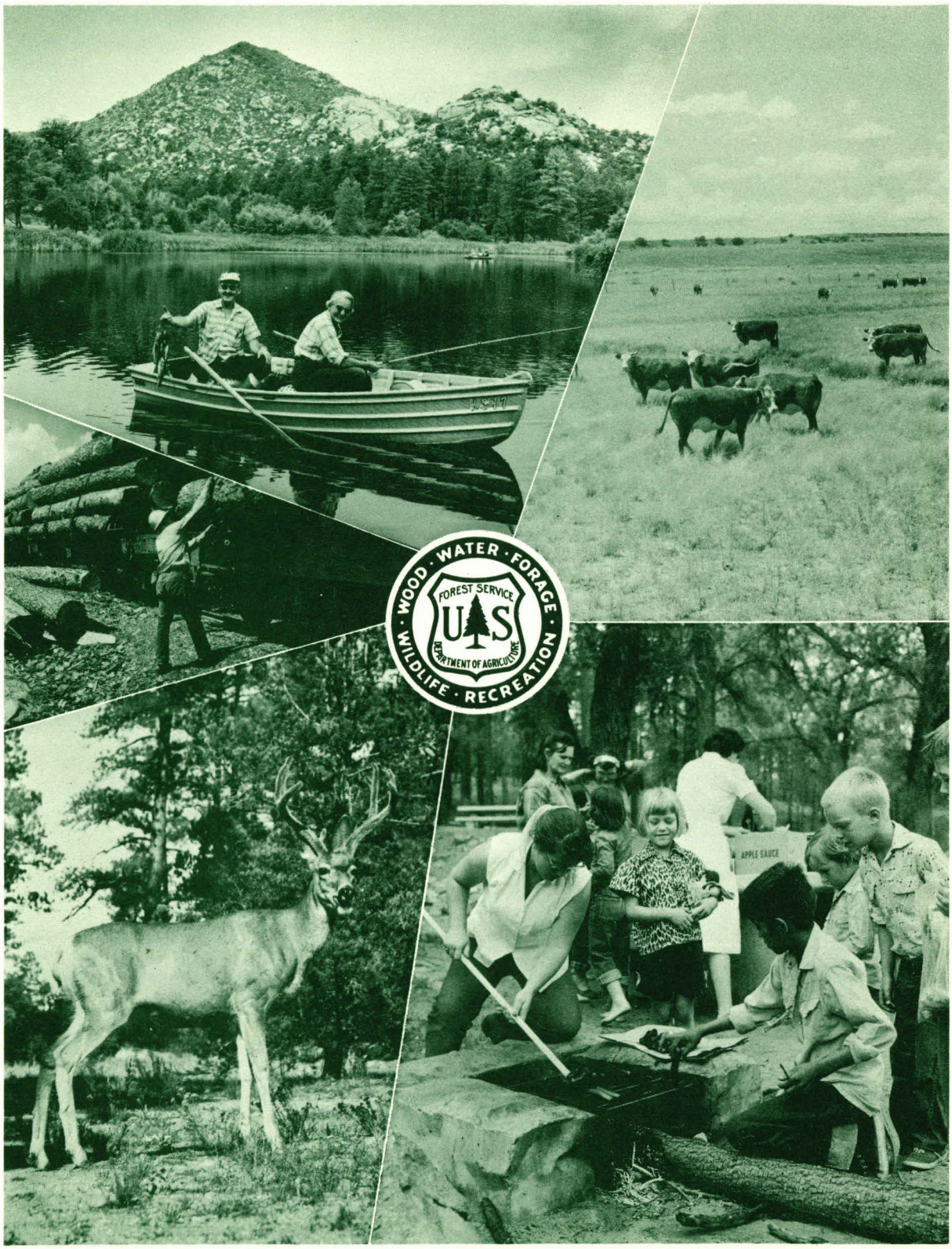
ROCKY MT. FOREST & RANGE
EXPERIMENT STATION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NATIONAL FOREST WATERSHED PROJECTS IN ARIZONA

In his message to the Congress on July 31, 1953 President Eisenhower said:

> "The Federal Government has a responsibility to manage wisely those public lands and forests under its jurisdiction necessary in the interest of the public as a whole. Important values exist in these lands for forest and mineral products, grazing, fish and wildlife, and for recreation. Moreover, it is imperative to the welfare of thousands of communities and millions of acres of irrigated land that such lands be managed to protect the water supply and water quality which comes from them. In the utilization of these lands, the people are entitled to expect that their timber, minerals, streams and water supply, wildlife and recreational values should be safeguarded, improved and made available not only for this but for future generations. At the same time, public lands should be made available for their best use under conditions that promote stability for communities and individuals and encourage full development of the resources involved."

The twin conservation objectives of national forest management — multiple use and sustained yield — are clearly identified in the President's statement.

The National Forests are not single-use properties. They have many resources. Our responsibility is to manage the National Forests so that they serve all the American people.

The southwestern National Forests are important sources of timber, forage, wildlife, recreation and water. The National Forests supply about 63% of the timber used by the sawmills in New Mexico and Arizona. Last year, over 5,000,000 visits were made to the attractive recreational areas on the southwestern National Forests. These National Forests contain over 2,000 miles of fishing streams and 65 lakes which receive more than half a million fishermen visits each year. The Forests provide the bulk of the big game habitat, and some 46,000 big game animals, mostly deer, are harvested yearly. The Forests provide forage for over 220,000 cattle and 147,000 sheep which graze under permit.

For the Southwest as a whole, water is probably the most important single product of the National Forests. Without it there would be no need for the other resources. We are fully aware of the need to make the watersheds in the forests as efficient as practicable in the production of useable water. Our pilot test and research projects for this program are designed to develop methods of optimum forest land management with intelligent coordination of uses.

The Beaver Creek pilot test watershed project is located in the Coconino National Forest and covers more than a quarter million acres. The two main drainages within it are the Wet Beaver and the Dry Beaver which converge to form Beaver Creek about six miles above where

This paper was given by Regional Forester Kennedy at the Third Annual Watershed Symposium "Progress In Watershed Management," held in Phoenix, Arizona on September 21, 1959, and sponsored by the Arizona Water Resources Committee and the Watershed Management Division, Arizona State Land Department.

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EXPERIMENT STATION

Ponderosa pine stand before thinning.

Same stand, one year after thinning.

it empties into the Verde River. The Verde, so vital to Salt River valley irrigation and domestic and industrial use, gets an estimated 10% of its water from Beaver Creek, at a point about a mile above the town of Camp Verde. The top of the Beaver Creek watershed is on the Mogollon Rim where some six feet of snow falls in the average winter. This plus the summer rains produce about 100,000 acres of ponderosa pine in the upper end of the two intermediate drainages. Below the pine in both the Wet and Dry Beaver are extensive pinyon-juniper woodlands where precipitation totals about 15 inches annually, and below these are other thousands of acres of grassland-and-desert-shrub types where the rainfall gets down to 12 inches or less on the average. Through accurate long-term measurements are not available, the average run-off of Beaver Creek is estimated to be 50,000 acre feet a year, or a little more than 2 inches of the surface precipitation.

The overall aim in our treatment of this large watershed is to find out what we can do, how to do it, and how much it costs to effectively manage a watershed.

One specific aim in our treatment was to reduce the density of stands in the 100,000 acres of ponderosa pine by several different methods and degrees of reduction, determining the effects of these removals on water yields, soil movement, and timber growth. On one of these trial areas, for example, the goal was to reduce stand density to 80 square feet of tree-trunk area per acre — considered to be optimum stocking level for good timber production in ponderosa pine.

Work-progress in this pine type to date has been as follows: 3500 acres have been given pre-commercial thinning, that is the weeding out of the smaller, poorly formed trees for the benefit of the more promising ones. This cost approximately $12 per acre. In addition, some 840 acres have been pruned, a further improvement of the stand costing 28 cents a tree or a little more than $8 per acre. Much of the pine stand is interspersed with clumps of Gambel's oak and New Mexican locust. An attempt has been made to kill out these clumps on 2300 acres by poisoning, at a cost of $9.30 an acre. So far, we have not developed a method for successfully poisoning the larger sized Gambel's oak.

On Watershed 7, a 2300-acre pine stand near Stoneman Lake, measures have been applied aimed at placing the timber in the best possible condition for increasing wood production. A commercial timber sale removed defective, diseased, mature and over-mature trees leaving only those smaller sawtimber stems which are sound and productive. Next, pulpwood size stems, 6″ in diameter and over, were poisoned at a cost of $6.00 per acre. In addition, oak and locust in the area were also poisoned. A limited amount of pruning has been done and total costs of bringing Watershed 7 to what is considered optimum growing density for ponderosa pine amounts to about $27 an acre.

Another trial, started in 1958 and finished this year, was the complete removal of the pine and other trees from a 150-acre sub-watershed, converting the area to grass. This has been the most spectacular treatment applied so far in the pine. Watershed 11 was the drainage selected, and it is located in the lower edge of the pine in what is often referred to as the fringe type. About half this area supported a moderately heavy stand of alligator juniper mixed with scattered poor quality ponderosa. The other half was thicker in pine with considerable Gambel's oak scattered throughout.

After a commercial timber sale removed all merchantable material on the watershed, bulldozers, power saws and hand labor were used to clear the slash and remaining woody stems and pile them in windrows for burning. The entire area was then seeded with a mixture of yellow sweet clover and wheatgrasses (crested, intermediate and western or bluestem) in a 2-3-3-3 mixture at seven pounds to the acre. Approximately 20 acres were drill-planted, the balance being hand-sown. Excellent August rains followed seeding, and a good stand resulted. The slash has been burned and seed was broadcast

ARIZONA

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WILLOW CREEK
and
BURRO MOUNTAIN PROJECTS

PHOENIX

VEGETATIVE ZONES IN RELATION TO NATIONAL FORESTS

SPRUCE

PINE

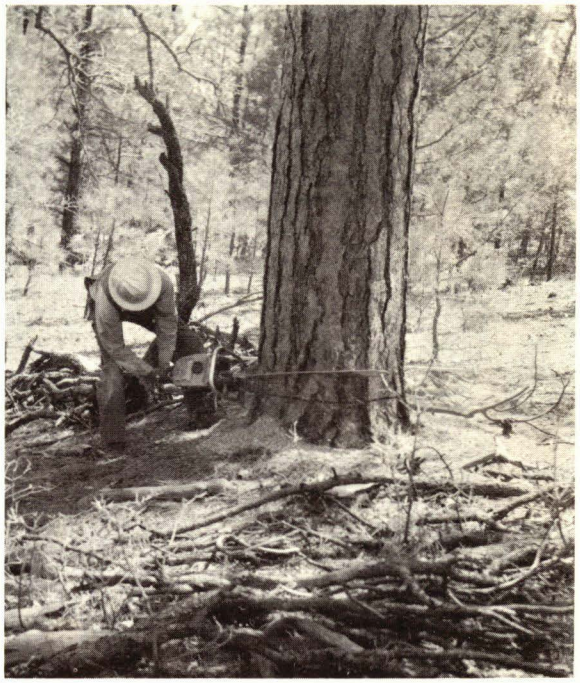
PINON - JUNIPER
CHAPARRAL

IRRIGATED LAND

WATERSHED 11

(Conplete conversion from trees to grass)

Area before conversion.



During conversion.

During conversion.

After removal of all tree growth - reseeding to grass.

into the ashes. The entire watershed has been fenced to protect the new seedlings from grazing. However, the newly seeded area is getting considerable use by elk.

Costs for this complete conversion have been high. $74 per acre so far plus $13 an acre for slash burning and follow-up seeding; also an estimated $8 an acre for repoisoning of oak sprouts over the next four years. Complete conversion cost is $95.00 per acre.

Another specific goal was to remove trees and shrubs on 48,000 acres of the juniper-pinyon type. Evaluation of this work will be made on six sub-watersheds which are being reserved for treatment after calibration.

Several techniques are being used to do the juniper control job. Cabling or pulling the trees out with a cable hooked to two bulldozers is the best mass method in dense stands of old Utah juniper. Nine thousand acres of cabling had been done by June 30 of this year. This is followed by single "hula-dozers" pushing the larger trees left by the cabling, some 6000 acres having been given this follow-up. In addition, the single machines have cleaned out 1620 acres of the heavier alligator juniper where cabling was impractical. Labor crews working with hand tools are following up taking out the small trees missed by the dozers. More than 5000 acres of this hand work was finished by June 30 of this year. Average cost of the whole process so far has been slightly under $11 an acre.

After a dense stand of Utah juniper had been treated, the debris remaining on the ground was so thick as to make livestock and big game movement in the area practically impossible. In addition, these heavy accumulations might also have some effect on water production unless removed. Accordingly, it is planned to burn 2,000 acres in this condition and then seed to grass.

Research has indicated that the chemical Fenuron may prove effective in killing Utah and alligator juniper. This has been tried on Beaver Creek this past year in a small way, and if it proves successful, greater use will undoubtedly be made of this chemical in the future.

Grass seeding has been finished on some 8600 acres of the juniper-cleared areas, at the cost of $1.39 an acre. Hand-casting and cyclone-seeding was done on all bare and disturbed areas left by the juniper work, with mixtures of yellow sweet clover, crested, intermediate and western wheatgrass in the higher elevations. Lower down, weeping and Lehman's lovegrass, sand dropseed, blue and sideoats grama and crested wheatgrass were used. Success has been just so-so, ranging from good to poor. Research indicates that this is to be expected in the pinyon-juniper type, a fact which shows how important it is not to allow a forage cover to be grazed out or crowded out by juniper in the first place.

The Forest Service is also carefully studying the relationship which this work on Beaver Creek will have on livestock grazing. Approximately 100 range transects have been laid out to determine effects on forage production. 200 seed traps to assess acorn quantity have been established by the Arizona Department of Game and Fish in cooperation with the Coconino National Forest. Browse measurements and game counts are also being made and the State of Arizona has assigned a biologist to this project.

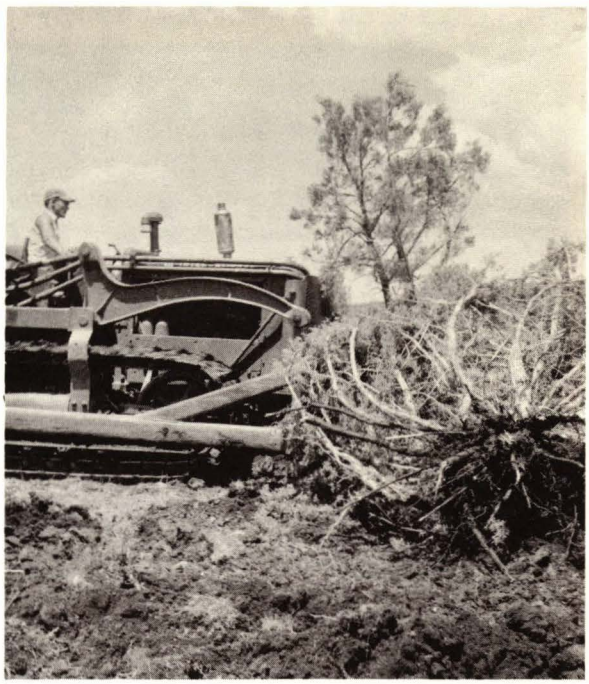
This summer a standard soil survey was made of the entire 276,000-acre Beaver Creek Watershed. This was done by qualified Forest Service soil scientists who found some 50 soil types and classified them into 8 characteristic groups for management purposes. They found that some of these soils are deep, some rocky and shallow; some absorb water rapidly with a relatively low erosion hazard and others absorb water very slowly and erode rapidly. We suspect that some watersheds, made up mostly of one type of soil, are high water producers. Other watersheds made up of another soil association may be only medium to low water producers. We have much to learn about the soil-plant-water relationships on forest lands.

To summarize the first 3 years' work on the Beaver Creek project, the following accomplishments should be noted:

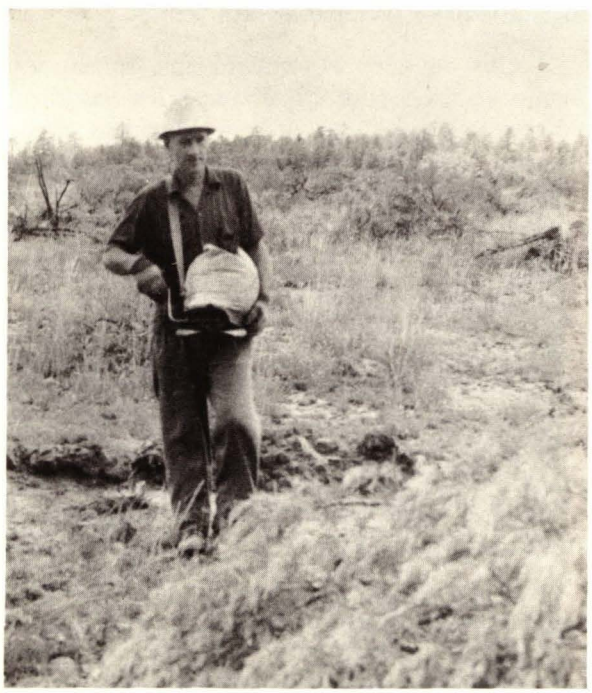
1. A road network has been roughed out to

JUNIPER CONTROL

Typical stand of juniper.



Removal of juniper by bulldozer.



Reseeding treated area.

Taking out small junipers missed by bulldozer.

provide access to stream gage sites and treatment areas.

2. One-sixth (9,000 acres) of the work planned in the pinyon-juniper type has been completed. 8600 acres in this type has been reseeded to grass.
3. Six percent (6000 acres) of the work planned in the ponderosa pine type has been completed.
4. Two intermediate watersheds and 14 sub-watersheds have been designated for intensive study and treatment. Three of these 14 are in Utah juniper subtype, 3 in the alligator juniper, and 8 in the pine.
5. All sub-watersheds are now equipped with precision concrete flumes and recording stream gage (cost about $4,000 each) as well as standard and recording precipitation gages.
6. The two intermediate watersheds are equipped with the larger U. S. Geological Survey type stream gages (which run $7,500 or so each). Two more of these large-sized gages will be installed this year; one on Wet Beaver and one on Dry Beaver.
7. Four complete weather stations have been established in the area.

PRELIMINARY RUNOFF FIGURES FOR 24-MONTH PERIOD ON BEAVER CREEK

(Fall 1957, 1958 and Spring 1959)

Three Type	Precipitation In Inches	Runoff In Inches	
Ponderosa Pine	51.4″	10.6	Average of two watersheds
Alligator Juniper	48.5″	3.6	One watershed only
Utah Juniper	42.1″	2.0	Average of two watersheds

In addition to the various types of treatments now underway on the Beaver Creek, prescribed burning tests will be conducted this year in the ponderosa pine type to determine effects on water yield and other resources. This work will be carefully done and will employ the surface or ground type of fire. This is the one that burns slowly along the ground consuming twigs, branches, and brush.

We also plan to set up some grazing studies in treated and untreated pine areas to determine effect on forage and livestock production.

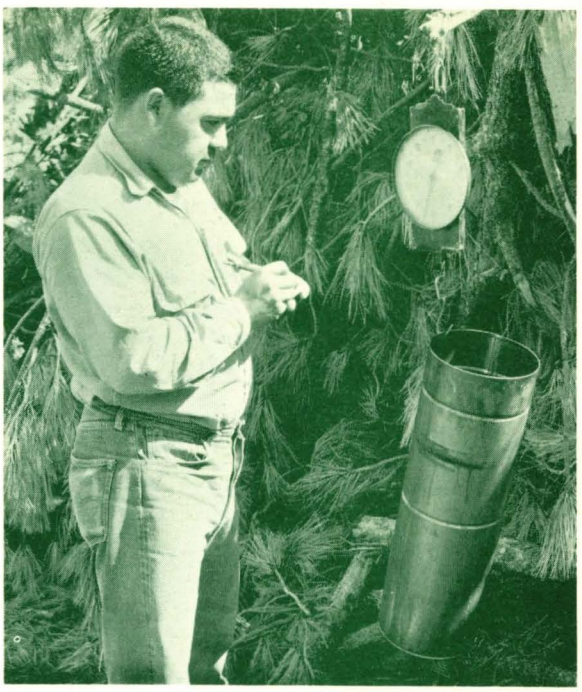
Over in the Apache National Forest we have several watershed pilot projects going in the spruce-fir country of the White Mountains. Spruce-fir grows only in the high mountain areas which are not too extensive in Arizona but which produce the most water per acre. Both the areas selected are above 9000 feet, getting an estimated 30 or more inches of rain and snow-melt a year.

Three drainages in the Willow Creek area have been chosen for study. These vary in size from 288 acres to 515 acres. Each has been or will be equipped with a stream gage and recording stand precipitation gages. Records are being kept of current runoff and precipitation under natural conditions. After a calibration period, two of the areas will be logged under systems of timber cutting yet to be determined. Comparisons will be made of water yields in relation to precipitation. A third drainage nearby will be left untreated and is to be measured as a control.

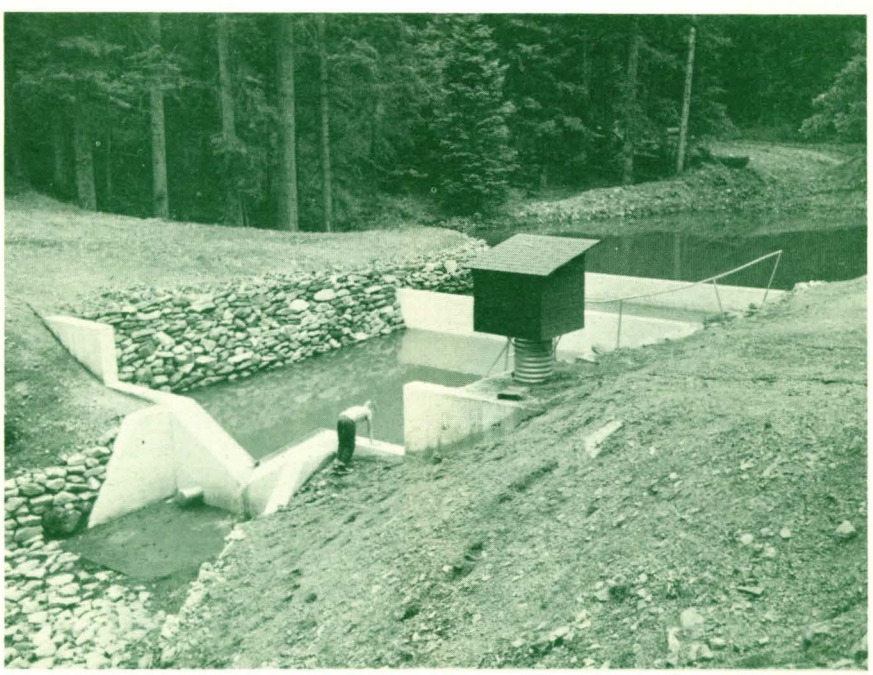
On Burro Mountain northwest of Big Lake, a 730-acre watershed has been selected to test the various methods of timber harvesting that might be used in the spruce-fir type. For example, clear-cutting of all timber in one patch has been completed and selective cutting of various intensities is going on others. More than half of this work has been completed. In addition, we are getting an inventory of precipitation and runoff for this particular area. We are just getting started on Burro Mountain and costs are running high. However, a sizeable pulp mill is just about ready to be installed in Snowflake, Arizona and when completed this will enable us to better utilize the smaller sized timber in this area.

We certainly do appreciate this opportunity to bring the members of the Arizona Water Resources Committee and their guests a brief picture of our work to date. I would also like to express my sincere thanks for the wonderful support which your group has given this project.

U. S. Geological Survey type gage installed on tributary of Wet Beaver Creek.



Weighing standard rain gage to determine precipitation.



V-Notch Weir in operation on Burro Mountain Watershed.

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